REMARKS

By the present amendment, claims 7 and 8 are pending in the application.

It is submitted that new independent claims 7 and 8 correspond to elected Group IV of the restriction requirement, i.e., the elected species illustrated in Fig. 4 and that new claims 7 and 8 of the present amendment correspond to elected claims 3 and 6 which were the claims of elected Group IV corresponding to Fig. 4.

Support For Claims

The arrangement of the rolling mill in new independent method claim 7 is substantially the same as the arrangement of the rolling mill in prior, now canceled, independent method claim 3 and is illustrated in Fig. 4 of the drawings.

The arrangement of the rolling mill in new independent apparatus claim 8 is substantially the same as the arrangement of the rolling mill in prior, now canceled, independent apparatus claim 4 and is illustrated in Fig. 4 of the drawings.

The "calculating" step and "controlling" step of prior, now canceled, independent method claim 3 have been set forth in more detail in new independent method claim 7 of the present amendment.

The "calculation devices" and "control device" of prior, now canceled, independent apparatus claim 6 have been set forth in more detail in new independent apparatus claim 8 of the present amendment.

With reference to the specification at page 5, lines 4-5 and page 6, lines 32-33, each segment of the split backup rolls independently has a load measuring device. See Fig. 5(c) which is an A-A sectional view of Fig. 5(a). Specification, page 8, line 3. Fig. 5(a) is a schematic for the rolling method of (1) to (3) and the rolling apparatus of (4) to (6).

Specification, page 7, lines 28-33. Fig. 4 is a schematic view of the rolling method of (3) and the rolling apparatus of (6). Specification, page 7, lines 24-27. New independent method claim 7 corresponds to the rolling method (3) and new independent apparatus claim 8 corresponds to rolling apparatus (6).

Fig. 5(c) illustrates an independent load measuring device 9 (9-1, 9-2, 9-3, 9-4, 9-5) associated with each segment of the split backup roll 5 (5-1, 5-2, 5-3, 5-4, 5-5).

With reference to page 13 of the specification, the horizontal direction component or rolling direction force acting on the work rolls is determined for each segment of the split backup rolls.

With reference to page 13, lines 28-32 of the specification, Fr^{W} and Fr^{D} are rolling direction forces acting on the work rolls at the right side or operator side and the left side or driving side, respectively. With reference to the specification at page 1, lines 21-25, the operator side is the right side and the driving side is the left side.

Fr^{W} and Fr^{D} are determined on the basis of the measured value of the load "q" for each segment of the split backup rolls. See, e.g., specification, page 13, lines 16-32.

Fr^{df} is the left-right balance of the rolling direction force acting between the rolled material and the work rolls. $Fr^{df} = Fr^{W} - Fr^{D}$. See, e.g., specification, page 14, lines 1 to 7.

With reference to the specification, e.g., page 14, lines 8-23, there is a controlling of the left-right difference of the roll gap between the upper work roll and the lower work roll to result in the calculating difference Fr^{df} approaching zero.

The Present Invention

The present invention relates to a method and apparatus for measurement of the rolling direction force on each segment of the split backup rolls, calculation of the difference between the rolling direction force acting on the work rolls at the right side and left side of the work rolls and control of the left-right difference in the roll gap between the upper work roll and lower work roll so that the calculated difference between the rolling direction forces acting on the right side and left side of the work rolls approaches zero. This results in a flat rolled metal materials having no or extremely little camber.

The present invention enables camber control of flat-rolled metal materials with a high degree of accuracy and results in stable production of flat-rolled metal material with no or extremely little camber.

In accordance with the present invention, measurement or assumption of metal sheet thickness at the entry side or exit side of the work rolls or the measurement or assumption of deformation resistance in the width direction of the metal sheet is not required.

The present invention is an epoch-making technology which is not influenced by the asymmetry of the sheet thickness of the rolled material at the entry side and/or the exit side or the temperature distribution of the rolled material in the width direction of the sheet.

§102

Claims 3 and 6 were rejected under 35 U.S.C. §102(b) as being unpatentable over Japan No. 06-262207 to Ogawa et al. (hereinater "JP '207").

This rejection, as applied to new independent claims 7 and 8 of the present amendment, is respectfully traversed.

Patentability

As pointed out in the Office Action, the rolling mill of cited JP '207 has split backup rolls split into at least three segments and each segment of the split backup roll has an independent load measuring device.

Paragraphs [0013] and [0019] of JP '207 suggest shape control of the rolled material.

Paragraph [0013] of JP '207 reads in part:

> [0013] "further, since this rolling mill has a small mill hysteresis, by measuring total rolling load and calculating mill rigidity, it is also possible to assume the thickness of the rolled sheet during the rolling. Therefore, when this rolling mill is used, control of the shape and the thickness of the sheet with a high-precision can be realized."

Paragraph [0019] of JP '207 reads in part.

> [0019] "A rolling is performed by using a rolling mill of the present invention and using a shape feedback controlling where, based on the output of the load detection device of each of the split backup rolls, the reduction amount of the reduction device of each of the split backup rolls is controlled so that the rolling load distribution of each of the split backup rolls falls in a targeted load distribution."

JP '207 does not disclose or suggest any concrete method for controlling the camber or shape of the flat rolled material using the measured load at each of the segments of the split backup rolls. The disclosure of JP '207 regarding the control of the camber or shape of the flat rolled material is vague and not concrete.

JP '207 makes no disclosure or suggestion of the present invention which calculates the difference between the rolling direction force at the right side and left side of the work rolls based on the measured load at each segment of the backup rolls and controlling the left-right difference of the roll gap between the upper work roll and lower work roll to result in the calculated difference approaching zero.

The method and apparatus of the present invention defined in new independent claims 7 and 8 of the present amendment is not disclosed or suggested by JP '207.

It is therefore submitted that new independent claims 7 and 8 are patentable over Japan No. 06-262207.

CONCLUSION

It is submitted that in view of the present amendment and foregoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the application, as amended, be allowed and passed for issue.

Respectfully submitted,

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Dated: October 25, 2007

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